

Chapter 3

Maintenance Support Operations

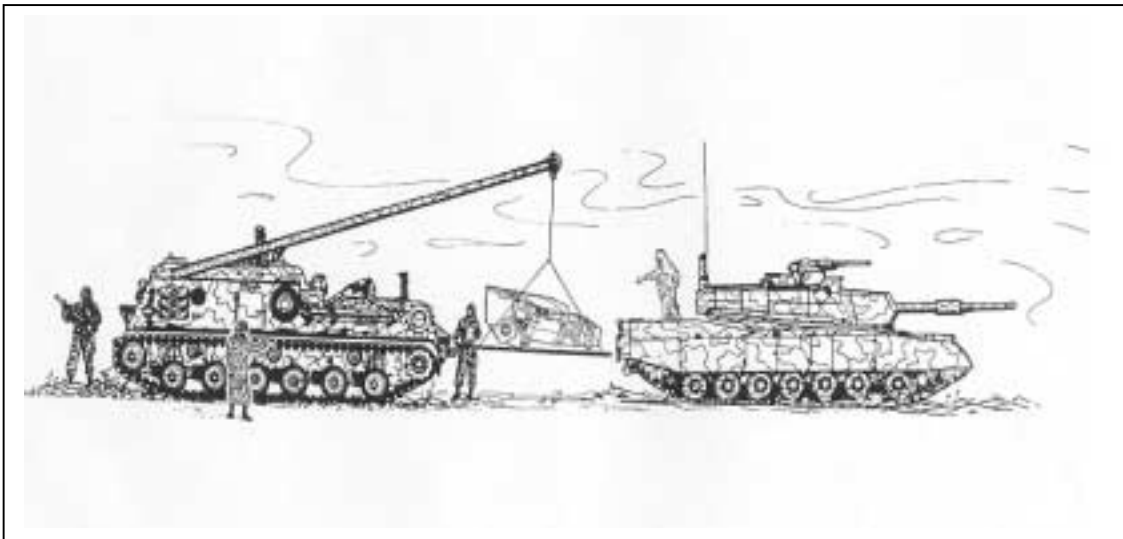
Chapter 3 describes various types of maintenance operations, including maintenance support, production control, and maintenance during stability and support operations (SASO).

SECTION I – TACTICAL OPERATIONS

3-1. Section I discusses the employment of maintenance units throughout the battlefield. Unit-level maintenance is affected by the pace and type of combat. METT-TC determines location of supported equipment, workload, availability of support, and time available for repairs. Fast-moving situations reduce maintenance effectiveness. Increased distances degrade communications between maintenance teams. Each type of combat operation requires unique planning.

UNIT-LEVEL MAINTENANCE—OFFENSIVE OPERATIONS

3-2. The four general phases of offensive operations are preparation, attack, exploitation, and pursuit. Phases, which are roughly sequential, may develop into a more fluid operation or into a defensive operation. This potential for change must be considered in planning maintenance support of offensive operations. Offensive operations are marked by forward movement of combat elements. As the operation moves forward, support elements join in the movement.



PREPARATION

3-3. Preparation involves the concentration of logistical support. Maintenance personnel place maximum maintenance effort on preparing

equipment for combat. The maintenance platoon in the combat trains moves closely behind the task force main body elements during this phase. The platoon's position in the march column is selected to support the combat units while protected from enemy fire.

ATTACK

3-4. The attack is quick and violent. The battalion maintenance officer monitors the tactical situation to support the attack. The BMO informs the S3 and S4 of specific UMCP locations. On-site maintenance support and recovery operations are accomplished with high risk.

3-5. During the attack, the majority of the maintenance platoon is located in the TF combat trains area. The CMTs are forward with the maneuver companies. Maintenance activities during this phase concentrate on recovery and BDAR. After the attack, the BMO coordinates maintenance requirements with the battalion XO. They discuss the current situation, priority of effort, and plans for the next operation.

EXPLOITATION AND PURSUIT

3-6. The TF covers a large area during the exploitation and pursuit phase. Combat units strike at objectives deep in the enemy rear while keeping pressure on retreating enemy forces. Command, control, and communications are extremely difficult. CMTs perform on-site repair. Equipment that cannot be repaired on site is recovered to the UMCP or BSA, whichever location can best complete the required maintenance. Maintenance platoon personnel perform quick repairs in the UMCP. Equipment in the UMCP may be repaired on the spot or evacuated to the field trains or brigade support area. The UMCP and the field trains move forward to support exploitation and pursuit operations.

PLANNING

3-7. Planners ensure maintenance operations support momentum and massing at critical points. Maintenance personnel maximize momentum by fixing inoperable equipment at the point of malfunction or damage. They enhance momentum by keeping the maximum number of weapon systems operational. Therefore, maintenance and recovery personnel perform their mission as far forward on the battlefield as possible.

RESOURCES

3-8. Organizational maintenance resources are in increased demand. Unit mechanics accompany or follow the most forward attacking elements. Plans include recovery of weapon systems that mechanics cannot fix within established maintenance repair time lines. Maintainers use battle damage assessment and repair (BDAR) to rapidly return disabled essential equipment to the commander.

DIRECT-SUPPORT-LEVEL MAINTENANCE—OFFENSIVE OPERATIONS

3-9. The maintenance unit commander prepares for support of offensive operations in much the same way as the maneuver unit commander. The maintenance unit commander appraises the combat situation, determines the needed support, and then organizes resources to provide the

maintenance support. DS maintenance units, as part of the division, must maneuver and deploy to provide maintenance support. Maintenance support operations are influenced by the division's deployment and its organization for combat, the tempo and type of combat operation, and the availability of suitable terrain.

COMBAT

3-10. In some combat situations, maintenance units are deployed well forward; in other situations, they are deployed to the rear. In some cases, maintenance units accompany or closely follow supported units; in others, they remain behind until ordered to move forward. In still other situations, the bulk of the maintenance units may deploy before supported units do.

3-11. The type and tempo of combat also affect the nature of the DISCOM maintenance units' workload. During fast-moving offensive operations, the maintenance shop workload may be light. When the advance slows or the pursuit phase ends, maintenance units must increase their activities. During the offensive phase, priority will be placed on recovery, BDAR, and roadside repair or on collecting, classifying, and reporting abandoned equipment.

COMMAND, CONTROL, AND COMMUNICATIONS

3-12. Offensive operations are characterized by fast movement and rapid changes in the situation. Command, control, and communications for the CSS effort are difficult. Maintenance elements normally operate as part of a larger CSS element, which reduces some of this difficulty.

Control

3-13. The DISCOM provides information to the division headquarters on the locations of all support elements operating in the division area. Under conditions of rapid movement and displacement, it is not always possible to provide specific information on the proposed locations of units in sufficient time for inclusion in division orders.

3-14. In a fast-moving situation, the DISCOM might be able to keep the division operations center informed only of its command post (CP) location. This information is contained in administrative orders, on operations overlays, or in fragmentary orders. With this minimal information, units must locate the DISCOM CP to obtain precise locations of subordinate units. The DISCOM continues to provide follow-up reports or situation overlays to support the division's daily operations report.

Coordination

3-15. In extremely fast-moving situations, DISCOM units operating in forward areas may move before advising the DISCOM headquarters. These units coordinate their movements and locations with the major subordinate command headquarters (normally brigade). Because of distances involved and communications limitations, it may not be possible for these units to effect timely notification to the DISCOM in the DSA.

3-16. However, since major subordinate headquarters report all new locations to the division operations center, the DISCOM headquarters will learn of new locations of brigade trains areas from the division TOC. Each DISCOM unit is responsible for notifying its parent headquarters of the

opening and closing of its CP and for providing advance information of planned moves. Advance information is essential for providing support forward.

OFFENSIVE GROUND OPERATIONS

3-17. Table 3-1 lists support procedures units should complete before initiating offensive ground operations.

Table 3-1. Support Procedures

Step	Action
1	Inspect and perform required maintenance on unit equipment.
2	Fill equipment shortages and repair parts stockage to authorized or directed levels, focusing on critical items.
3	Prepare and disseminate operations and administrative orders.
4	Establish support priorities, including priorities for issue of operational readiness float stocks and critical repair parts
5	Establish procedures, priorities, and conditions for resupply.

NOTE

At higher levels, plans, orders, and mission assignments are broad in scope. At successively lower echelons, plans are more complete and detailed.

PLANNING

3-18. Prior to offensive operations, maintenance planners should consider the following:

- Available support units.
- Stockage levels for repair parts.
- Forward placement of MSTs and UMCP.
- Channels and procedures for recovery, collection, evacuation, and disposition of captured or abandoned materiel.

RESOURCES

3-19. DS maintenance resources are in increased demand. DS maintenance elements in the form of MSTs may also operate with the spearhead of the attack. MSTs and other elements need the right people (skills, numbers), equipment (transportation, tools, TMDE, communications), and supplies (components, assemblies, repair parts).

REPAIR PARTS STOCKAGE

3-20. Repair parts stockage (in terms of days of supply) is kept consistent with mobility requirements. Based on type of operation, geographical area, and terrain/weather conditions, certain items are increased. For example, extensive operations over rough terrain dictate a buildup in stockage of vehicle springs, shock absorbers, and tires. Forward-deployed MSTs

increase stockage of small high-usage RX items like fire control instruments and automotive subassemblies.

OPERATIONAL TEMPO

3-21. As the tempo of the situation and the distance involved increase, support units may have difficulty keeping pace with requirements. Maintenance support is positioned as far forward as possible, normally placing MSTs with the BMO in the UMCP. In operations where the overall situation requires bypassing pockets of the enemy or guerrilla elements, the effects of bypassing on support units and other logistical activities must be considered. In some situations combat elements may be required to provide security.

REDIRECTION OF SUPPORT

3-22. CSS commanders and staff officers must plan for redirection of logistical support to satisfy changing tactical requirements. Redirection of effort and supplies, redeployment of units, realignment of the support structure, and changes in support procedures and emphasis take time and require close coordination and planning. Continuous movement limits the time available to make repairs.

OFFENSIVE MOMENTUM

3-23. If the offensive is successful and gains momentum, a culminating point may be reached where logistical support limitations make the entire force vulnerable. Lacking the ability to maneuver and displace as rapidly as combat forces, CSS forces may be outdistanced by combat units. Resupply of repair parts by unit distribution may break down or become ineffective due to lack of transportation, difficulty in locating units, and increased order ship time.

EXPEDIENT METHODS

3-24. The task force commander must be kept informed of the tactical situation's effect on the support structure's capability to provide the support required. Expedient methods for providing maintenance support under these circumstances include—

- Institution of BDAR.
- Authorization of controlled exchange
- Procedures and controls allowing MSTs to draw items anticipated to be needed from the main warehouse, ASL, or RX high-usage items.
- Increased emphasis on evacuation of unserviceable equipment, with repair operations in forward areas limited to component replacement, adjustment, and servicing.
- Round-the-clock operations by supporting units to the limits of physical endurance.
- Use of air transportation to move maintenance personnel and repair parts.
- Attachment of MSTs to tactical units.

MAXIMIZING REPAIR

3-25. Maintenance units must maximize repair efforts forward. Unserviceable equipment requiring more than limited component replacement, adjustment, and servicing will be recovered to a centrally located MCP. The centralized MCP maximizes BDAR cannibalization and controlled exchange operations. Unserviceable equipment requiring extended repairs is consolidated and turned over to follow-on maintenance elements. Figure 3-1 shows various maintenance activities and the flow of maintenance elements in the forward area in support of offensive operations.

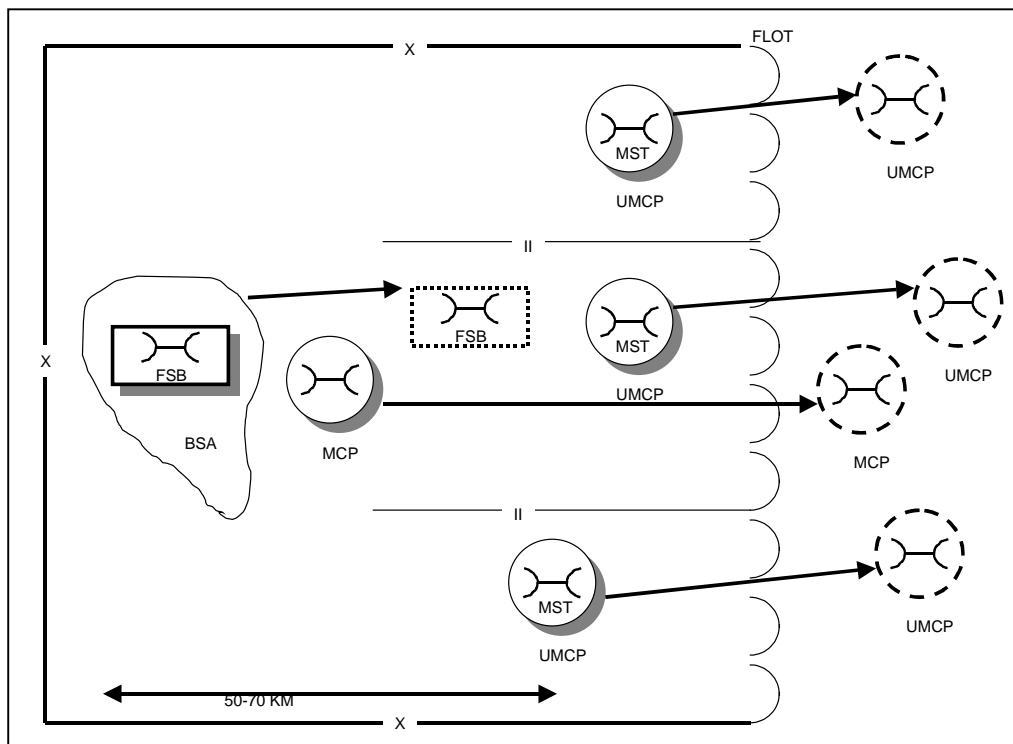


Figure 3-1. Flow of Maintenance Elements, Forward Area, Offensive Operations

UNIT-LEVEL MAINTENANCE—DEFENSIVE OPERATIONS

3-26. Types of defensive operations include area defense and mobile defense. Activities associated with defensive operations include counterattacks, passage of lines, withdrawals, and relief to continue the defense. Large defending formations, such as the division, may have portions of their forces conducting any of these operations or activities simultaneously. Defense may be static or dynamic. It takes a coordinated effort to defeat the attackers and prevent them from achieving their objectives.

MOBILE DEFENSE

3-27. Maintenance support of the mobile defense is marked by reduced available maintenance time, which reduces opportunities for on-site maintenance and CMT support. Equipment that cannot be repaired or recovered must be destroyed to prevent enemy capture.

AREA DEFENSE

3-28. More time is available for maintenance in the area defense when a unit is not actively engaged with the enemy. This provides an opportunity to conduct maintenance to improve materiel readiness.

PLANNING

3-29. The primary thrust of the maintenance effort in the defense is to maximize the number of combat-ready weapon systems that are ready. Once the defensive battle begins, the thrust is to fix the maximum number of inoperable systems and return them to the battle. This requires forward support at, or as near as possible to, the intended area of operation of the systems. Maintenance teams locate well forward. Likewise, critical components are placed forward to overcome the effects of combat wear and damage.

3-30. Planners also consider augmenting the maintenance support to covering force elements when they return to the main battle area. Such support may allow them to return more rapidly to fighting condition.

DIRECT-SUPPORT-LEVEL MAINTENANCE—DEFENSIVE OPERATIONS

3-31. Direct-support-level maintenance support for defensive operations must be planned, organized, and executed with the same attention to supported unit requirements as to offensive operations. Supported units in the defense are not as widespread as in the offense. Maintenance support operations can, therefore, be more centralized. Defensive operations also do not require displacement as often as in the offense, which simplifies command, control, and communications. The exception is support of retrograde operations like delay or withdrawal. The need for continued support while engaged in a unit move makes this a difficult operation to support.

MAINTENANCE SUPPORT TEAMS

3-32. MSTs deployed with maneuver units are task-organized to maximize on-site repair capability. A team may relocate several times a day, keeping pace with supported units. Maneuver organizational maintenance elements must assess unserviceable equipment for on-site maintenance or recovery to the nearest MCP.

FORWARD MAINTENANCE COLLECTION POINTS

3-33. The forward MCP generally contains MST elements not deployed with maneuver units. Initial BDA is made and a plan is formulated for each unserviceable item. MST elements notify follow-on maintenance elements of maintenance requirements beyond their capacity in order to allow follow-on elements to better allocate their maintenance resources. The base company and forward MCP must leap-frog forward in order to maintain continuous support.

MOBILE DEFENSE

3-34. A mobile defense requires maneuver and movement on the part of elements of the defending force. Maintenance units may also expect to move more frequently than during an area defense. In a mobile defense, maintenance requirements are greater than in area defense, particularly for tracked vehicles. This results in increased recovery distance from forward MSTs to maintenance elements farther to the rear.

AREA DEFENSE

3-35. In an area defense—

- The defending force remains in position for longer periods. Movement and maneuver of the defending force are considerably reduced in comparison to a mobile defense or an offensive operation.
- Support units are not required to move as often as in other types of operations.
- More time is available for maintenance operations.
- Maintenance facilities can operate better, since they do not have to react so often to changing situations and requirements.

REPAIR PARTS STOCKAGE

3-36. Repair parts stockage is generally focused on supporting critical weapon system components. Care should be exercised in selecting only needed items so as not to impair mobility. Equipment inspections and technical assistance are emphasized to maintain readiness at a high level.

DELAY AND WITHDRAWAL

3-37. Detailed planning, control, and coordination are required to support delaying or withdrawal operations. Emphasis is given to evacuation of unserviceable equipment that cannot be repaired before opposing forces overtake the position. Displacement of support elements must not conflict with the movement of combat units. When possible, maintenance support units should be displaced at night.

PLANNING

3-38. Maintenance plans must be closely coordinated with the tactical plan to provide maximum support without interfering with combat elements' operations. MSTs will be attached to tactical units to provide a rapid on-site maintenance capability.

UNIT-LEVEL MAINTENANCE—RETROGRADE OPERATIONS

3-39. Units are dispersed during retrograde operations. Command, control, and communications are difficult. A high degree of coordination is required. Movement of combat elements may be performed under enemy pressure.

3-40. Maintenance operations concentrate on quick repairs, BDAR, controlled exchange, and cannibalization. MSTs in the UMCP move to predetermined locations to support combat elements.

SUPPORT PRIORITY

3-41. Maintenance is concentrated on those weapon systems and materials directly required to support the retrograde operation. Priority of support should be given to units that have completed the movement to the next location and are preparing a new position. Emphasis must be placed on items that can be repaired most readily. Other equipment should be evacuated directly to future planned support areas. Extensively damaged and nonrepairable equipment should be used for controlled exchange or cannibalization.

EQUIPMENT RECOVERY

3-42. Destroy equipment that cannot be repaired or recovered to prevent enemy capture. Recovery capability is of utmost importance. The first method of choice is self- and like-vehicle recovery. Wheeled and tracked recovery vehicles are used at critical points to keep the route of march open. Recovery support sections remain close to the combat unit to assist the CMT's recovery assets.

3-43. Recovery equipment is critical to support of retrograde operations. Its use must be rigidly controlled and coordinated. Recovery equipment should be marshaled at critical locations to keep routes open and to recover all materiel possible. Badly damaged equipment should be evacuated or destroyed. Specific instructions must be provided for destruction of supplies and equipment.

PLANNING

3-44. Continuous maintenance support throughout the retrograde operation is essential to keep the maximum number of weapon systems operational. Maintenance planners should concentrate on providing essential support forward while moving the bulk of the maintenance units to the rear. They organize teams to provide support to essential weapon systems in the forward areas.

3-45. Maintenance efforts should concentrate on "quick fix" items, using assemblies brought forward to facilitate rapid turnaround of weapon systems. BDAR and fixing equipment take priority. Maintainers should maximize use of controlled exchange and cannibalization.

RECONSTITUTION OPERATIONS

3-46. Reconstitution is an extraordinary action used to restore units to a desired level of combat effectiveness commensurate with mission requirements and available resources. No resources exist solely to perform reconstitution. It is a total process whose major elements are reorganization, assessment, and regeneration. FM 100-9 contains more information on reconstitution.

REORGANIZATION

3-47. Reorganization is a shift of resources within a degraded unit to restore its combat effectiveness. Reorganization can be immediate or deliberate; it includes cross leveling, matching crews to equipment, and forming composite units from two or more attrited elements.

ASSESSMENT AND REGENERATION

3-48. Assessment and regeneration is done as far forward as possible so units may return to combat with minimum delay. It occurs normally in the support area two levels higher than the unit being reconstituted. It measures a unit's capability to perform its mission and evaluates regeneration needs.

3-49. Maintenance support of these operations initially consists of assessing the damage. It then shifts to repairing as many weapon systems as possible to meet the commander's priorities.

BATTLE DAMAGE ASSESSMENT

3-50. BDA is used to appraise major weapon systems status. This effort shows the number of items destroyed or damaged beyond repair in the forward area and the number that can be repaired forward. It also shows the location of forward maintenance and salvage collecting points and the transportation required to support recovery or evacuation. Mechanics concentrate on mission-essential maintenance only and the priorities established by the senior commander.

NIGHT OPERATIONS

3-51. Night operations use the same organization and require the same functions as daylight maintenance support. Commanders continue to effect internal adjustments of their organic maintenance assets to meet unique situations. Additional maintenance assistance is requested from higher echelon resources when needed. Maintenance elements retain responsibility for performing their assigned function. Those that must be deferred until daylight remain the responsibility of the deferring maintenance element.

TRAINING

3-52. The goal of night maintenance operations is to attain the same degree of effectiveness as in daylight operations and to sustain the effort over long periods of time. Intensive night training is a key element in attaining this goal. Such training improves the capabilities of unit personnel performing technical tasks under less than normal light conditions and provides a sound basis for developing a night maintenance SOP.

3-53. Tasks that cannot be performed under subdued visible light or night vision goggles are identified. Procedures are developed for deferring them until daylight hours. Procedures are developed for preposition of equipment, tools, and repair parts supplies to allow ready access, identification, and handling at night. Procedures for night movement and relocation stress light discipline and camouflage.

PLANNING

3-54. Detailed planning for maintenance support of night operations is essential. Maintenance support planners must provide a realistic assessment of the capability to support night operations.

3-55. The assessment is based on the degree of proficiency attained by the maintenance elements concerned in training and on the SOP for night maintenance operations. Requirements must be identified and coordinated

for additional maintenance support from higher echelons to assist in working off the repair of items deferred for daylight maintenance.

3-56. With the present night vision technology, planners must anticipate built-in backlog each morning. They must ensure that the maintenance support plan provides timely support without interfering with or compromising the tactical plan.

PROCEDURES

3-57. Using night vision devices, organizational and DS maintenance elements repair and return to service those critical items within their repair capability. Night vision devices are used for tasks that must be done outside. Bulky items or repair parts supply, as well as equipment and tools, are pre-positioned for rapid location, identification, and handling during the night.

3-58. Where enemy observations may be possible, field expedient drape-type shelters are constructed to hide the light source. Lightproof shelters with visible subdued light are used for the repair of small items of equipment like radios and small arms. They also provide a place to use required technical manuals. The tactical commander must approve the use of subdued visible light.

3-59. Night recovery is conducted on a case-by-case basis depending on the tactical situation and the need for recovery of the item. Equipment, tools, and repair parts are prepositioned and marked for easy location, identification, and handling. Elements must also be concerned with aerial observation of heat and light source signatures. Where required, the supported unit provides security for the recovery element. MSTs that may be dispatched from support elements into areas farther forward should have night vision devices.

NBC ENVIRONMENT

3-60. Maintenance personnel must be prepared to provide maintenance support on the integrated battlefield. To do this, individual soldiers must be trained to survive an initial nuclear, biological, or chemical attack and to continue the mission in a toxic environment under great mental and physical stress.

3-61. Leaders must recognize that performance in an NBC environment is greatly degraded, which has a detrimental effect on mission performance. Refer to Table A, FM 3-4, which highlights this performance degradation. Long-term problems caused by contamination make it doubly important that maintenance units protect themselves. When possible, maintenance activities should occupy protected areas like underground garages or concrete buildings to provide cover from liquid chemical agents and shielding from radioactive contamination.

CONTAMINATED EQUIPMENT

Standing Operating Procedure

3-62. Units should establish SOPs for contaminated vehicle and equipment maintenance procedures:

- Responsibilities for establishing and operating contaminated and uncontaminated MCPs.
- Procedures for operating contaminated and uncontaminated MCPs.
- Procedures for performing unit-level hasty decon or requesting deliberate equipment decontamination from an NBC defense company.
- Procedures for contaminated equipment inspection.
- Procedures for repair without electronic test equipment (destroyed by blast or electromagnetic pulse [EMP]).

Hazards

3-63. There are special hazards involved in working on contaminated equipment:

- Petroleum products tend to trap chemical contaminants.
- A vehicle that is safe for an operator without MOPP-4 protection may be unsafe for a mechanic to repair.
- Chemical contaminants may collect in bolt threads, hydraulic fluids, and closed assemblies. For example, a mechanic might break open an air filter and be exposed to lethal concentrations of hazardous vapors. Casualties could be high unless all repairs and preventive maintenance on previously contaminated vehicles are done in MOPP-4.
- Oil, grease, and dirt seriously degrade the protective qualities of a chemical overgarment. Mechanics must keep themselves as clean as possible. Extra overgarments should be on hand to replace dirty ones.
- Wet-weather gear helps keep overgarments clean but increases heat buildup and will eventually be penetrated. The combination of protective gear and wet-weather gear provides good (although hot) protection from a combination of toxic chemicals, grease, and oil contamination. Fuel handlers' aprons and field expedient rubber sleeves provide some added protection with less heat buildup.
- Mission performance is greatly degraded. Repair times are significantly increased with increased MOPP levels. This reduced capability affects the combat readiness of supported units.

Control Principles

3-64. Do not spread contamination or bring contaminated equipment into a clean area. Units may establish separate MCPs or, at a minimum, separate storage areas for contaminated and uncontaminated equipment. Mark equipment to protect others. Every effort must be made to repair contaminated equipment in a contaminated area.

3-65. At the MCP BDA/NBC detection point, all personnel and equipment returning from forward areas are properly routed to control the spread of contamination during the repair process. Units will establish an NBC control point for monitoring and decontaminating personnel. Equipment will be decontaminated prior to evacuation to the supporting backup DS-level maintenance facility. All equipment evacuated must be marked with the level of decontamination it has undergone. All equipment evacuated to EAC must be decontaminated and marked using the x-system.

Marking Vehicles and Equipment

3-66. Mark vehicles and equipment to protect others. Vehicles and equipment that are contaminated or that have been deconned to low-risk levels for operators and crews could still present a serious hazard to mechanics. They need to know that the equipment has been contaminated.

Standard contamination signs

3-67. Contaminated vehicles must be identified with standard triangular contamination signs on all four sides and at the operator's controls. The type and date of contamination should be written on the signs. The signs should be easily visible from the outside of the vehicle. Contamination signs on vehicles and equipment contaminated with persistent agents will not be removed even after decontamination. Nonvehicular equipment should be similarly marked in a conspicuous location.

Additional marking system (x-system)

3-68. An additional marking system may be used to alert personnel of possible hazards as well as to show the level of decontamination the equipment has undergone.

3-69. The x-system is the easiest to use. The mark must be made in a contrasting color so that it can be seen from all directions. If a vehicle is marked, the logbook must specify where the contamination was located as well as the results of each decontamination attempt. See Table 3-2 for a description of the four levels of decontamination.

Table 3-2. X-System

Level	Description
X- One	Item is contaminated; no decontamination was attempted.
XX- Two	Item underwent immediate or operational decontamination: <ul style="list-style-type: none"> • Crew or individual soldier removed gross contamination and prevented its unnecessary spread. • Item should still be handled very carefully; only gross surface contamination was removed.
XXX - Three	Item underwent a more detailed decontamination: <ul style="list-style-type: none"> • Detection tests after decontamination attempts show negative results. • Disassembly may not have been done; some contamination may be discovered if item is broken down further.

Level	Description
XXXXX - Five	<p>Item was disassembled and completely decontaminated:</p> <ul style="list-style-type: none">• Completely disassembled and usually exposed to extreme heat for sufficient time to completely destroy all of the agent.• If item could not be subjected to heat, other methods ensured absolute decontamination.

NOTE

A contaminated item is marked initially and then modified as different levels of decontamination are reached.

3-70. No item without at least an XX marking will be taken into MCPs. A detailed decontamination results in an XXX marking. Corps chemical unit decontamination results in an XXXXX marking. Only those marked XXXXX will be evacuated to EAC.

Disposition

3-71. Whenever possible, return contaminated repaired equipment with no more than a negligible risk to the owning contaminated unit. Even if equipment has gone through hasty decon, it can still be hazardous to handle. A previously contaminated unit will already be conducting periodic contamination checks and will be able to use the equipment safely because of the precautions being taken.

Evacuation

3-72. Contaminated equipment and tools must be stored at a location downwind of clean areas. Every effort must be made to control the spread of contamination. Contaminated vehicles and equipment should not be sent to the base shop for repairs. NBC considerations may outweigh established maintenance repair timelines. If DS-level maintenance is required, an MST will be sent forward to make repairs in the contaminated MCP. DS maintenance units should treat all customer equipment as contaminated until detection equipment proves otherwise.

Tools

3-73. Since it is difficult to decontaminate equipment well enough to eliminate risk to mechanics, it may be impractical to decontaminate tools and equipment used to repair contaminated equipment. Segregate tools and equipment used to repair contaminated equipment from other tools. Use these contaminated tools and equipment to repair contaminated equipment.

SAFEGUARDS

3-74. Even though decontamination is done, MSTs cannot be sure that toxic vapor trapped by oil or held inside a closed assembly will not appear at some point during the maintenance process. Because decon cannot guarantee safety for unprotected mechanics, the maintenance officer must decide which MOPP level mechanics should use. This is a tactical decision. Mechanics should use MOPP levels consistent with the threat and the mission.

3-75. Safeguards must be taken to protect people both inside and outside contaminated areas. Chemical agent detection equipment should be operated while contaminated equipment is being repaired. The testing must be a continuous process. Vapor hazards may not be present in open terrain; but as soon as the vehicle is moved into an area where air does not circulate, significant toxic vapors may concentrate.

CONTAMINATED PARTS REMOVAL

3-76. If a vehicle is contaminated and a part removed for use elsewhere (controlled exchange), the part must also reflect the appropriate level of decontamination. This must be done due to the possibility of hidden contamination. Potentially, a removed item could contain a hidden agent that was never detected. It could pass through all the various levels of maintenance and then be released once it is disassembled. It is worth the few seconds it takes to mark an XXX.

CONTAMINATED ASSEMBLIES

3-77. If contamination is detected after an assembly is opened, the assembly can be deconned quickly by flushing with diesel fuel or motor gasoline. The unserviceable component must then be marked and taken to the contaminated holding area, where it can undergo more thorough decon. For reparable assemblies, personnel should either wait until the assembly no longer gives off vapor or replace it with a new assembly. The fuel used for flushing must also be marked "contaminated" and dumped into the contaminated sumps at the decon site or disposed of per unit SOP.

RADIOLOGICAL CONTAMINATION

3-78. Maintenance personnel repairing equipment with radiological contamination should wear dosimeters and be closely monitored for radiation exposure. They must never exceed exposure levels. When the highest acceptable levels are reached, personnel should be replaced, mission permitting.

3-79. The amount of radiological contamination that personnel should be exposed to will vary depending on operational exposure guidance and the tactical situation. Priority for monitoring equipment should go to the recovery teams, then to inspection points, and then to the MCP. MSTs should satellite off their supported units for NBC monitoring as much as possible. Figure 3-2 shows how an MCP is set up to accommodate both contaminated and uncontaminated equipment repair on the integrated battlefield.

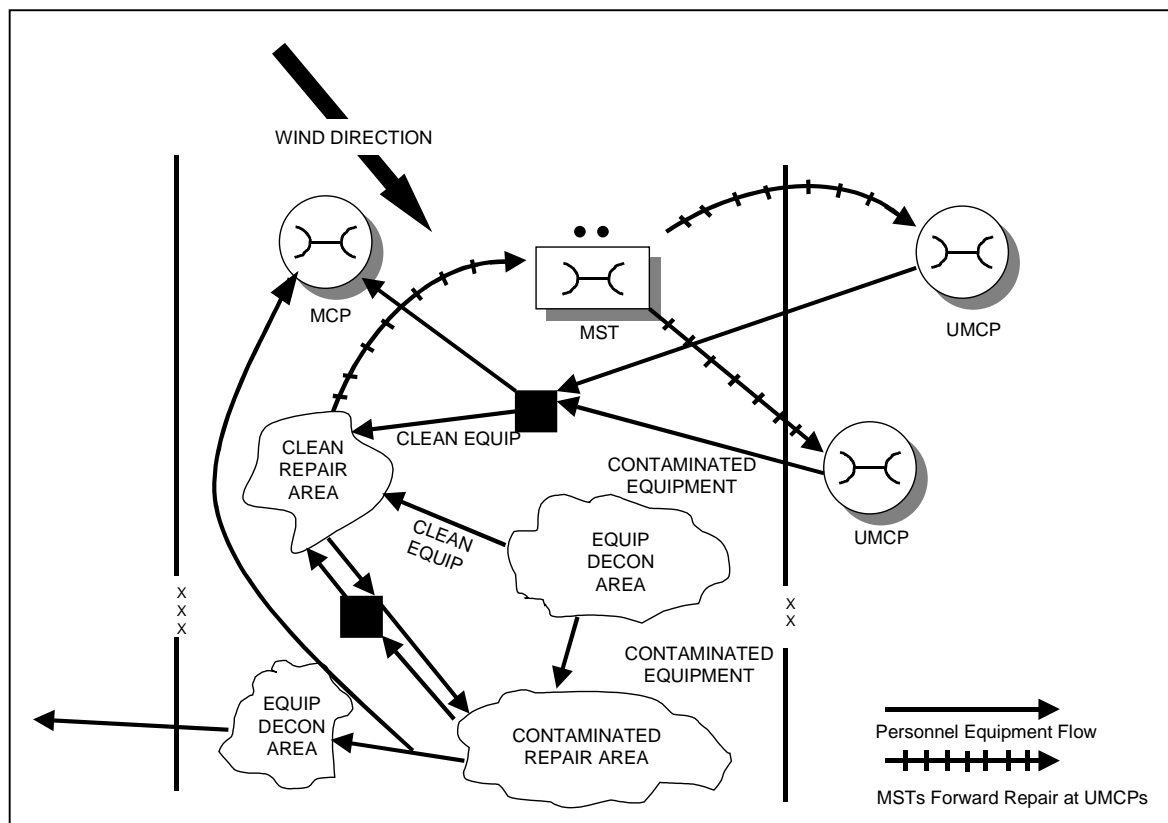


Figure 3-2. MCP for Contaminated and Uncontaminated Equipment Repair

CLEAN AREA SUPPORT STRATEGY

3-80. The strategy for supporting from a clean area is the prevention of contaminated personnel from entering the clean area. Work within a clean area can thus be done at reduced MOPP and with greater efficiency. When NBC attacks occur within the combat area, the unit must assume that all equipment is contaminated, and the maintenance unit will set up separate inspection points and MCPs.

3-81. All vehicles, personnel, and supplies must pass through the inspection point before they enter the maintenance area. Here, inspectors in MOPP-4 can use heaters or torches to warm equipment while they check it for contamination. The vapor hazard from liquid contamination may be undetectable at 65°F (18°C) in the open yet become lethal at 80°F (26°C) or when brought into a closed area. Some biological contamination, including toxins, may not be detectable. Assume contamination is present if the equipment came from a known contaminated area. Radiac meters can easily detect radiological contamination.

INSPECTION TEAM

3-82. The inspection team must segregate the equipment. Uncontaminated equipment can go straight to the clean maintenance area. Contaminated vehicles and equipment must be marked with contamination signs.

3-83. A decision must then be made on the disposition of each item. If equipment is contaminated and repairs can be performed in MOPP-4, the item is sent through decontamination or left to weather. If weathering is the choice, the marked equipment is placed in a holding area where it can decontaminate itself. Waiting for equipment to weather before repair may be a luxury a commander cannot afford. In cool weather, weathering can take weeks. If the choice is to decontaminate, consider the following:

- Before any repairs are made, equipment should go through decontamination to a level deemed necessary by the command.
- Priority equipment must be decontaminated first. Setting priorities is often not easy. For instance, there may be four armored personnel carriers equipped with antitank weapons. If they are lightly contaminated, perhaps all four could be decontaminated and repaired in the time it would take to decontaminate and repair one heavily contaminated tank.
- Decisions require coordination between maintenance units and operational staffs.

Decontamination

3-84. Decontamination should be done only if it is cost-effective. When a persistent agent is involved, every effort should be made to replace a contaminated component with the next higher assembly that can be replaced in MOPP-4. Contaminated equipment or components should be marked and placed in the holding area to await disposition instructions from higher headquarters.

On-Site Maintenance

3-85. Uncontaminated teams should not perform on-site maintenance and generally should not attempt recovery of contaminated equipment. Unserviceable, contaminated equipment and vehicles should be recovered to the decontamination site or contaminated MCP by other contaminated vehicles.

SUPPORT TEAMS

3-86. Both organizational and DS-level maintenance activities will send teams forward to repair or recover vehicles and equipment if it is unknown whether the vehicles and equipment are contaminated. Teams must be in MOPP-4 and they must test the equipment for contamination. Testing is a continuous process. Vapor hazards may not be present in open terrain, but significant toxic vapor may concentrate as soon as the vehicle is moved into an area where air does not circulate.

3-87. If contamination exists, the teams must decide whether or not repairs can be made in MOPP-4. If they cannot, the equipment must be deconned. Any surfaces the team will touch to repair or recover the vehicle must be given an operator's hasty decontamination with an on-board decontamination apparatus (such as the M11 or M13). This will not reduce

the level of MOPP needed, but it will offer some additional protection and limit the spread of contamination.

3-88. Tools used for contaminated equipment maintenance may remain contaminated if further maintenance of contaminated equipment is needed. Use rags to wipe off only the gross contamination. Dispose of the rags in a sump or bury them and mark the location. Teams may go through a MOPP gear exchange or detailed troop decontamination, but the team's equipment and tools should be left alone.

3-89. A fresh team can use the contaminated tools on other contaminated equipment. For extended repairs, a rested team relieves a contaminated team, which moves back and undergoes detailed decon. After a rest, the newly deconned team rotates forward and relieves the contaminated team.

TIME AND RESOURCES

3-90. It may be possible to extend the length of time the unit can continue to support from a contaminated location by scheduling periodic withdrawal of personnel to a clean area for complete personnel decontamination and a rest period at a reduced MOPP level. For continued effectiveness, however, the unit must leave the area, go through a detailed equipment and decontamination process, and set up shop in a clean area.

3-91. Time may dictate that only the most critical repairs continue while a portion of the unit moves to a clean area. Limited organic transportation may require that some unit and customer equipment be left behind. After reorganization at the clean area, this equipment may be recovered or repaired using the procedures described for supporting from a clean area.

CONTAMINATION AVOIDANCE

3-92. Avoiding contamination should be the keystone of the support strategy in an NBC environment. Unit NBC defense personnel should monitor the NBC situation by maintaining contact with higher headquarters and their counterparts in supported units. Before dispatch of MSTs, as much information as possible must be obtained relating to the threat along the route of march and at the support location. The location and availability of complete equipment decontamination stations must be carefully monitored. These facilities are operated under the supervision of elements of the corps chemical company.

SECTION II – NONDIVISIONAL MAINTENANCE UNITS

3-93. Section II discusses the employment of maintenance units throughout the battlefield.

MAINTENANCE BATTALION

3-94. The DS maintenance battalion normally provides support to all units located in or passing through a designated area, although it may operate in whole or in part in support of specially designated units.

LOCATION

3-95. The battalion normally operates from multiple locations within its assigned area of operations. The HHC is located as centrally as possible within the area. Maintenance companies are located in various parts of the battalion area of responsibility and are oriented on equipment densities. Factors affecting the position of DS units include—

- Tactical situation.
- Road network.
- Availability of suitable terrain for CSS.
- Security requirements.
- Location of other support activities.

3-96. Maintenance companies may be temporarily attached to another DS maintenance battalion when the situation warrants. For example, when one DS battalion of a support group is not employed to the full extent of its productive capacity, while the other battalion in the group has exceeded its capacity, a temporary attachment of maintenance assets to the overtaxed battalion may be necessary.

REPAIR EXCEEDING CAPABILITIES

3-97. Maintenance is performed either in the supported unit with MSTs or in MCPs of DS maintenance companies. Equipment exceeding repair capabilities or capacities of the maintenance company may be evacuated to another DS maintenance company in COSCOM or TAACOM or a GS maintenance unit in theater.

BATTALION HEADQUARTERS

3-98. The battalion is assigned specific areas of responsibility by the ASG or CSG based on mission assignments made by COSCOM or TAACOM. In the support area assigned to the battalion, the headquarters assigns specific areas to attached unit commanders and assists in reconnoitering sites for new areas of operation. Support group headquarters is continually kept apprised.

MISSION

3-99. Battalion headquarters keeps track of workload, production, and maintenance issues of subordinate units through reports, visits, liaison, and briefings. The battalion headquarters must also stay alert to potential changes in mission and inform subordinate units accordingly. Mission

changes might include support of new units, changes in unit end item priority, and a requirement for repair parts fabrication. Battalion headquarters provides attached units with pertinent instructions governing operations and performs maintenance management and staff supervision to ensure adherence to established policies.

AUGMENTATION

3-100. When the workload exceeds the unit's capability or capacity, the battalion headquarters makes appropriate recommendations to the CSG/ASG and MMC concerning augmentation requirements. Such action is taken only when maintenance management and control within the battalion will not solve the problem. Battalions normally contain at least three maintenance companies. When one of them becomes overloaded, battalion headquarters may augment that unit's capacity by temporarily attaching personnel and equipment from another unit.

NONDIVISIONAL (DS) MAINTENANCE COMPANY

3-101. The company establishes its base of operations in the area with greatest equipment density in its AOR and locates it as centrally as possible within the area. The area selected for operations should be adjacent to a good road network to facilitate easy access to supported units.

MISSION

3-102. The company provides DS-level maintenance, repair parts supply support, and technical assistance to units in its AOR. It may be tasked to provide backup or passback support to other maintenance companies and recovery/evacuation assistance to supported units. Out-of-sector support for specific operations may also be a mission of this company. METT-TC will determine the length of time a nondivisional DS maintenance company occupies a single field site.

ON-SITE MAINTENANCE

3-103. The company provides on-site maintenance to supported units when practical. This service is provided with the dispatch of properly manned and equipped MSTs to a supported unit UMCP or to the site of equipment failure. All company elements provide personnel for on-site maintenance as directed by the maintenance control section and set forth in the applicable TOE.

3-104. After receiving equipment, the maintenance control section inspects the items that can be inspected and fault-diagnosed without disassembly. It then schedules equipment for shop repair, depending on shop workloads, parts availability, priority of requesting unit, and priority of the specific equipment to support current operations.

SMALL ITEMS

3-105. Normally, small items and items requiring some disassembly (C-E equipment) or diagnosis using TMDE are sent to the appropriate maintenance shop after receipt. In the company, DS-level repairs consist of—

- Troubleshooting/replacing defective components and modules.
- Tightening and adjusting components.

- Welding operations.
- Repairing minor components using repair kits.

RECORDS AND REPORTS

3-106. Under a fully automated maintenance management system, most maintenance data and reports required by higher headquarters are submitted on diskette or transmitted by modem. The company operates SAMS-1 to manage maintenance and transmit data to the battalion support operations section. Data submitted by SAMS-1 pertains to DS maintenance company operations. The battalion support operations section transmits SAMS-2 data to the CSG/ASG, support operations section, or directly to MMC.

WORKLOAD

3-107. Normally, items repaired by the DS maintenance company are returned to supported units, except for items repaired for return to RX stocks (starters, generators, fuel pumps, etc) or to operational readiness float. Items repaired in a backup role are returned to the supported maintenance unit or direct support unit (DSU).

3-108. Workloads exceeding the company's capacity or capability are evacuated according to disposition instructions provided by the MMC. Instructions, which are normally preset, designate shipment to specific units based on type and condition of the item.

3-109. Items reparable at the GS level are evacuated through the Class IX supply system to a sustainment maintenance base. Certain items with specific condition-codes are evacuated to a C&C company. The maintenance company is required to report critical, controlled, or short-supply items to the MMC before evacuation.

NONTACTICAL INFORMATION SYSTEMS

3-110. The Defense Information Systems Network (DISN) is a worldwide, nontactical communications network established by the Department of Defense. The Defense Information Infrastructure (DII) is a worldwide complex of DOD-established information systems networks and control centers organized into a single, seamless, interoperable, long-haul, general-purpose Theater Communications System (TCS). DII facilities may be operated by any of the US armed services. In a theater of operations where the Army manages the DII, the responsibility is assigned to the theater signal command—Army (TSC-A).

3-111. The TSC-A commanding general has the mission to establish, operate, and control the TCS. The commander responds to the operational direction of the Army service component commander (ASCC) and the Defense Information Systems Agency (DISA) for the DII (Army) under his control. The TSC-A is responsible for expanding and restoring DII web links in theater and for providing liaison and interface to DII networks managed by the other services. During wartime, the TSC-A provides information systems support to the wartime theater army and its forces in the theater of operations.

3-112. DII and TSC-A fixed information systems facilities use fixed-plant, COTS, and complex systems unique to TCS or DII operations. System

complexity, criticality, and equipment configurations mandate that logistical support for nontactical information systems equipment be provided differently than for ASCC tactical equipment.

LOCATION

3-113. Supported sites may be dispersed over a large geographical area, and the equipment maintained may be unique to the theater of operations. A theater may use equipment operating in a frequency range different from another theater's. Equipment may include systems manufactured in the host nation.

SUPPORT ORGANIZATION

3-114. The TSC-A commander is responsible for the operation and maintenance management of facilities and resources that support, or relate to, the DII. The organization created to provide logistical support to nontactical information systems in TSC-A is the area maintenance and supply facility (AMSF). The AMSF may be a TDA organization or an MTOE organization with TDA augmentation. The AMSF provides both maintenance and supply support for TSC-A supported equipment. If specified in the mission statement or statement of work (SOW), the AMSF may operate as well as maintain telecommunications facilities for the TSC-A. The AMSF provides logistics support to fixed-station, semifixed, and special transportable information systems. Maintenance support provided by an AMSF includes DS, GS, and SRA levels.

FUNCTIONS

Maintenance

3-115. Maintenance functions performed at the AMSF include repair of components, assemblies, modules, and printed circuit boards (PCBs) evacuated by supported sites or MSTs. These include COTS equipment and systems. Repairs require specialized skills, special tools, TMDE, and disciplined quality control. Repaired items are returned to the sites or RX, or they are restocked in the AMSF. Items beyond AMSF's repair capability or the AMSF contractor SOW's scope are returned to the manufacturer for repair.

Supply

3-116. The AMSF provides C-E repair parts for information systems operated at supported sites. It maintains a stockage of repair parts, circuit components, modules, subassemblies, special design tools, and test equipment for its own operation as well as supported site requirements. The AMSF provides complete support for all peculiar repair parts requests and organizational PLL. Repair parts support to customer units does not include repair parts for other items of organizational equipment, such as automotive, arms, and NBC equipment. Non-C-E parts support is provided by the DS maintenance unit of the theater CSS organization charged with the normal DS support mission.

3-117. AMSFs requisition C-E repair parts and supplies directly from the appropriate CONUS national inventory control point (NICP) and other wholesale sources as prescribed by integrated logistics support (ILS) plans and wholesale interservice supply support agreements. They also receive,

store, maintain accountability for, and issue nonforce organic information systems project materiel and equipment (formerly referred to as Class IV project materiel) in support of the DII (Army).

Operational

3-118. If specified in the mission statement or SOW, the AMSF may also operate as well as maintain *selected* DII telecommunications facilities, AUTODIN, Standard Theater Army Command and Control System (STACCS), Defense Red Switch Network (DRSN), and government-owned, contractor-operated (GOCO) facilities in theater for the TSC-A.

SECTION III – LIAISON, ON-SITE, AND EMERGENCY SERVICES

3-119. Section III describes the liaison, on-site, and emergency maintenance services of DS maintenance units. Maintenance units must be mission-oriented and proactive in providing as much assistance to customer units as possible. Customer-oriented support is the overriding principle that all DS maintenance operations are based on. Maintenance units will provide on-site maintenance to supported units whenever practical. On-site support keeps the maximum amount of serviceable equipment in the hands of supported units, reduces operational downtime for certain types of equipment, and provides supported units with on-the-spot instruction and advice to improve their operations. It also reduces the maintenance unit's workload, as well as handling and transportation requirements that would be needed if all unserviceable equipment were work-ordered to the maintenance unit for repair.

LIAISON VISITS

3-120. To provide adequate, effective support, the location of the supported unit, its equipment status, repair parts supply status, equipment density, and repair requirements must be determined. Upon being assigned a support mission and arriving in their operating area, DS maintenance units perform liaison visits to make initial contact with supported units.

3-121. The support operations officer (SOO), accompanied by one or more key personnel, makes initial contact. Supported units are informed of the supporting unit's location, services to be provided, and procedures for obtaining these services. Maintenance and repair parts issues and requirements are discussed. After initial contact, liaison is maintained on a frequent basis. The DS unit commander makes additional visits to supported units to maintain good working relationships.

TECHNICAL ASSISTANCE

3-122. Technical assistance is providing instruction and technical guidance to supported units to enable them to perform their mission more efficiently. It can increase the quality of maintenance at the unit level, thus reducing the workload at the DS level. Technical assistance may be provided formally by the AMC Logistic Assistance Program or MACOM-level maintenance assistance and instruction teams (MAITs). The DS maintenance unit commander may also provide assistance informally. Technical assistance includes visits by technical assistance teams made up of competent experienced soldiers from the DS unit. The team's functions include, but are not limited to—

- Advising the supported unit commander on the responsibilities for unit-level maintenance and repair parts supply.
- Determining the nature and scope of maintenance support required so that a properly manned and equipped MST can be sent to provide on-site maintenance.
- Assisting the supported unit in the operation of maintenance management automation (ULLS-G).

- Discussing and resolving mutual maintenance support issues regarding personnel, equipment, or operational procedures and policies.
- Helping the unit commander evaluate equipment condition and the effectiveness of the maintenance program and formulate required remedial action.

ON-SITE MAINTENANCE

3-123. On-site maintenance support includes—

- Performing maintenance at the location of equipment failure or at the supported unit's MCP.
- Delivering repair parts directly to supported units.
- Providing technical assistance.

It also includes liaison visits to identify issues and requirements of supported units and to inform them of the support available and the procedures required to obtain it. Liaison teams and MSTs provide on-site maintenance support.

MAINTENANCE SUPPORT TEAMS

3-124. MSTs perform on-site maintenance. They may also be used to help supported units determine the condition of supported equipment and to provide advice and assistance for correcting equipment failures noted in inspections. The MST organization varies according to the mission.

Employment

3-125. Employment of MSTs depends on maintenance support requirements. Some teams are dispatched in response to a specific requirement in a specific area. They return to the DS unit after completing their mission. Other teams may operate away from the DS unit in a UMCP for extended periods. The maintenance control officer determines how the MST operates. It depends on the mission of the team concerned and known requirements for on-site maintenance support. MSTs not only are dispatched as a result of requests from supported units, but also to satisfy planned operations such as responses to anticipated requirements.

Equipment

3-126. MSTs will be equipped with the tools, equipment, and repair parts needed to do a specific job. When requesting on-site maintenance, supported units report the type of malfunction and any known parts requirements. MSTs must also know the supported unit's equipment density and any special support requirements (welding, for example). This helps determine the proper composition of personnel, equipment, and repair parts for the MST organization.

Personnel Assignment

3-127. When possible, personnel and supervisors are assigned to an MST permanently. This simplifies management, facilitates cooperation, and promotes better understanding of the job by team personnel.

ENVIRONMENTAL/TACTICAL SITUATIONS

3-128. The environmental or tactical situation and reports from supported units often permit an accurate forecast of on-site maintenance requirements. Caution and good judgment must be used. In a situation where supported units operate from remote locations, it may be necessary to attach a DS MST temporarily to the supported unit.

3-129. The relative merits of transporting personnel and equipment to repair items, as opposed to receiving items at the company base, must be weighed before a decision is made. This is especially true in situations where air transport is the only means of personal contact. In these situations, great reliance must be placed on providing DS-level maintenance at the supported unit's location, especially for maintenance of heavier and bulkier items, which are difficult to transport by air.

EMERGENCY MAINTENANCE SERVICE

3-130. Besides providing DS-level maintenance to specific units in a specific geographic area when requested, each DS maintenance unit provides emergency maintenance support. This service may be provided at the roadside, in the DS shop, or on site.

ROADSIDE SERVICE

3-131. Roadside service may consist of the repair of disabled equipment, BDAR actions, or recovery of disabled vehicles. Normal BDAR repair involves a minimum of parts, tools, and time. Fuel system failures, overheated engines, and electrical failures are the usual malfunctions. The form and scope of emergency roadside service are governed by need, the weather, the tactical situation, and traffic. Road patrols, recovery service, or maintenance elements at refuel points provide this type of service.

Road Patrols

3-132. Road patrols consist of two or more automotive mechanics in a light vehicle carrying a small stock of repair parts, repair kits, and tools. Patrols are dispatched and routed so they will pass any given point on a main supply route (MSR) at least every two hours. However, road patrols reduce the unit base shop maintenance capability. Emergency service is rendered on the spot to any disabled vehicle found along the route. When necessary, a recovery vehicle is called by the patrol to recover the disabled equipment to an MCP, evacuation point, or the DS maintenance shop.

Recovery Vehicle

3-133. A recovery vehicle may be stationed at a convenient intersection along the route or may remain on call in the DS maintenance unit. Recovery vehicles are the primary source of heavy-lift capability for removal and replacement of automotive power train assemblies in the field. Therefore, they should not accompany a road patrol unless the requirement for their services is known beforehand.

Refuel Points

3-134. DS-level maintenance support can be set up at refuel points along heavily traveled routes. This is a practical method of providing efficient, economical roadside maintenance service. Petroleum platoons can provide assets along roads for convoy refueling. These services can be extended to provide fuel to all vehicles using the route. A small maintenance element can also be located here. This element may consist of four to six automotive mechanics equipped with a vehicle and cargo trailer carrying small, easily replaceable repair parts and RX items.

3-135. While vehicles are being refueled, the maintenance element can assist the operator/crew in performing spot checks of the vehicle. Minor deficiencies can be corrected on the spot with available tools, repair parts, and BDAR techniques. Deficiencies that do not deadline the vehicle will be annotated on the DA Form 5988E. This form is given to the vehicle driver for action on return to the unit.

SECTION IV – STABILITY AND SUPPORT OPERATIONS

3-136. Section IV discusses maintenance during stability and support operations (SASO). SASO presents unique challenges to logisticians. Friendly CSS units are primary targets. Moreover, the constant presence of civilians in these areas of operation makes identification of threat elements very difficult. Defense against incidents such as boobytraps, sniping, theft, and partisan activities quickly reduces personnel and equipment resources. Recognizing operations inside and outside unit perimeters will be hazardous, logistics planners must prepare for and deliver timely maintenance support. Consult FMs 100-19 and 100-23. These manuals reflect operational doctrine prescribed by FM 100-5.

3-137. Divisional or nondivisional units may be deployed to provide maintenance support during peacekeeping, humanitarian, or disaster relief operations. They will probably be at least company size or larger. The type and density of customer equipment will largely determine the modular structure of subordinate maintenance companies. A maintenance company may be modularized as follows:

- One platoon to perform organizational maintenance for supported customers.
- One platoon to perform direct support maintenance.
- Sections and teams as needed to perform specific system support.

PEACEKEEPING

3-138. From a doctrinal standpoint, peace operations do not alter the way in which the Army performs maintenance. However, when planning maintenance support during peace operations, logisticians must consider the following factors:

- Hostile environment.
- Joint or multinational chain of command.
- Support to multinational forces.
- Risk assessment.
- Security of maintenance operations.
- Environmental impact.

3-139. Peacekeeping operations will most likely be accomplished as part of a multinational coalition. This presents new challenges for the maintenance commander, who could potentially support host nation military and commercial equipment. Also, there may be a requirement to support coalition force equipment. Beyond some of the special considerations noted here, much of the maintenance support for peacekeeping will not differ substantially from normal maintenance.

NOTE

FM 100-23 covers the full range of peace operations, including peacemaking, peacekeeping, peace enforcement, preventive diplomacy, and peace building.

HOSTILE ENVIRONMENT

3-140. National policy may require the Army, either singularly or as part of a joint or multinational task force, to conduct peace operations in politically sensitive areas of the world. At such times, regional combatants may disregard the peace initiative and continue a sporadic or repeated armed struggle. Commanders must anticipate this and be prepared to provide logistics support in hostile, potentially life-threatening situations.

LACK OF HOST NATION SUPPORT

3-141. Because friendly forces must operate in hazardous and politically sensitive areas, commanders should never assume availability of dedicated host nation support during peace operations. Instead, they must plan for maintenance support using organic resources.

MULTINATIONAL OPERATIONS

3-142. Because the Army frequently conducts peace operations with other nations, logistics commanders may encounter a multinational chain of command. In such cases, they must quickly establish communication channels to confirm or clarify mission requirements. Moreover, commanders must also determine how and from where they can expect timely resupply to perform their critical maintenance mission. Prompt coordination of mission and support requirements with higher headquarters ensures logistics planners deliver timely maintenance support to customer units.

3-143. Logistics commanders must anticipate support to all friendly forces. To accomplish that task, they must contact higher headquarters as well as known customer units to coordinate support requirements. At times, support to multinational forces may present unique logistical challenges. In such cases, logistics planners must take the initiative to determine customer equipment type and density.

RISK ASSESSMENT

3-144. When designated to provide maintenance support during peace operations, logistics commanders must carefully assess the risk threat to their organizations. Coordination with intelligence units and higher headquarters is a critical part of risk assessment. Based on equipment density and METT-TC, commanders identify potential security vulnerabilities and initiate appropriate courses of action. In some cases, a commander may require additional personnel and equipment resources to perform and sustain the mission.

SECURITY

3-145. Security is an important consideration for logisticians when planning maintenance operations during peacekeeping, humanitarian, or disaster relief operations. Security directly impacts the quality of support to customer units. When securing maintenance areas of operations, logisticians must do the following:

- Locate maintenance operations away from areas of dense population.
- Identify maintenance sites that units can easily secure and defend.
- Establish and secure lines of communication.
- Coordinate with engineer support for earthen barriers if required by the base cluster concept.
- Enclose maintenance operations areas with barrier material as part of the base cluster concept.
- Establish entrance and exit control points and procedures.
- Position crew-served weapons assets for maximum defensive firepower.
- Maintain responsive 24-hour perimeter security.

Unique Requirements

3-146. Sometimes METT-TC may not allow the security containment of an entire maintenance support unit. In such cases, logisticians consider security of only the most critical parts or nodes of the operation, using organic assets. When securing critical nodes, commanders initiate the following actions:

- Prioritize the criticality of each maintenance support mission.
- Assess organic resources and capability to secure individual missions.
- Request additional security resources from higher headquarters, if available.
- Designate available resources to secure highest priority missions first.

HUMANITARIAN OPERATIONS

3-147. As in peace operations, maintenance doctrine does not change during humanitarian operations. Nevertheless, humanitarian operations do introduce unique challenges to logisticians. Depending on the regional political situation, the Army may conduct humanitarian missions in either friendly or hostile environments.

3-148. Since humanitarian missions are conducted in either friendly or hostile environments, logistics planners must consider the situation and do the following:

- Locate maintenance operations away from dense population centers.
- Identify maintenance sites that units can easily secure and defend.
- Establish and secure lines of communication.
- Coordinate with engineer support for earthen barriers if required by the base cluster concept.
- Enclose maintenance operations areas with barrier materiel if required by the base cluster concept.
- Establish entrance and exit control points and procedures.
- Position crew-served weapons for maximum defensive firepower.
- Maintain responsive 24-hour perimeter security.

- Consider impact on the environment.

DISASTER RELIEF

3-149. During the summer of 1992, Hurricane Andrew devastated large areas of Florida. The ensuing calamity and distress placed the Army in a unique and significant support role.

3-150. In disaster relief operations, maintenance and logistics planners—

- Identify commercial vendors who can quickly supply the technical and repair parts support required.
- Organize assets from other agencies, contractors, and local maintenance resources for economy of effort.

3-151. Planners consider the impact on the environment, and they evaluate and prioritize repair of the following infrastructure equipment:

- Firefighting equipment.
- Medical equipment.
- Construction equipment.
- Generators.
- Organic equipment.
- Equipment belonging to other military elements involved in the operation.

3-152. The type of disaster provides the maintenance commander with some insight on whether to plan on availability of fixed facilities or to rely on maintenance under field conditions. The commander also considers how operations and facilities will conform with national, state, local, and host nation environmental laws. The type of disaster will dictate Class III and IX supply requirements.

SECTION V – ADVERSE ENVIRONMENTS

3-153. Section V addresses maintenance operations in desert, cold weather, jungle, mountain, and urban environments.

3-154. Regardless of the area of employment, key maintenance functions must be performed. FMs 9-207, 90-3, 90-5, 90-6, 90-10, and TB 43-0239 contain detailed discussions of operations in these environments

3-155. The first step in preparing for maintenance support operations is an analysis of the mission. Time, tools, skills, and repair parts (Class IX) are important to maintenance operations. A detailed analysis of the area of operations to identify lines of communications will play a major part in determining how maintenance support operations will be conducted.

3-156. In hostile environments, it is probable that lines of communications will be limited. Airfields, good roads, and railroads will be the exception rather than the rule. Airdrop of supplies and equipment is an effective alternative to air landing. Airdrop is a rapid means of delivery that makes deliveries to isolated units possible without further transshipping. Armor-infantry-mechanized (AIM) divisions have no organic airdrop support; they rely on corps units for airdrop support. Maintenance unit commanders must keep themselves informed at all times of user requirements and their own maintenance capabilities.

DESERT OPERATIONS

3-157. Maintenance support for desert operations requires an understanding of the environment. Temperatures vary according to latitude and season from over 136°F to the bitter cold of winter. In some deserts, day to night temperature fluctuation can exceed 70°F. Some species of animal and plant life have adapted successfully to desert conditions where annual rainfall may vary from zero to 10 inches. Desert terrain also varies from place to place; the common denominator is lack of water and little, if any, vegetation. This environment can profoundly affect military operations.

LOCATION

3-158. Desert locations are seldom close to normal lines of communication. The effects of the environment on equipment are severe, requiring increased levels of support to maintain a standard level of efficiency. Distances between units and lines of communication are long. Due to their importance, maintenance units are primary targets.

SECURITY

3-159. Enemy ambushes on MSRs are a threat in desert operations. Enemy patrols may lace nuisance mines on routes, especially at critical points. Certain actions can minimize the threat to supply routes:

- Patrol routes before immediate use and at irregular intervals when not in use. If the route is patrolled by surface vehicles, they must have maximum protection against mine blasts. MP patrols also provide a resource for continuous monitoring of supply routes.

- Locate observation posts so their surveillance equipment interlocks in poor visibility conditions. Observation posts can maintain a constant presence along the route but are relatively expensive in manpower.
- Schedule convoys at irregular intervals. Convoys may require armed escorts, as determined by the commander on the basis of METT-TC.

CLASS IX SUPPLY SUPPORT

3-160. Demand for Class IX supplies will increase due to environmental effects on equipment and the extra maintenance effort required. Small items with high-usage rates should be held as far forward as practical. Typical high-consumption items include—

- Filter elements.
- Tires.
- Water pumps, gaskets, fan belts, water hoses, and clamps.
- All parts for ignition systems.
- Wheel and sprocket nuts and wedge bolts.
- Spare caps for all liquid containers.
- Speedometers and cables (due to dead reckoning navigation, these are critical).
- Cleaning fluids for electronic equipment and windshields.

3-161. A unit's prescribed load list (PLL) depends on its equipment, but parts should be limited to only those items that prevent the equipment from performing if they failed. Larger, heavier items are carried by MSTs from the DS maintenance company. As demand varies from day to day, arrangements must be made for unexpected requirements to be moved to repair sites.

EFFECTS OF DESERT ENVIRONMENT ON EQUIPMENT

Terrain

3-162. Terrain varies from nearly flat with high traffic areas to lava beds and salt marshes with little or no traffic areas. Drivers must be trained to judge terrain in order to select the best method for conditions. Tracked vehicles are best suited for desert operations. Wheeled vehicles will go many places that tracked vehicles can go; however, their lower average speed on poor terrain may be unacceptable during some operations.

3-163. Vehicles should be equipped with spare fan belts, tires, and other items likely to malfunction, together with tow cables or chains (if not equipped with a winch), extra water cans, fuel cans, MREs, and desert camouflage nets. Air recognition panels, signal mirrors, and a tarpaulin (to provide shade for the crew) are very useful. Wheeled vehicles should also carry spurs, mats, or channels as appropriate to aid mobility.

3-164. The harsh environment requires a high standard of maintenance, which may have to be performed well away from specialized support personnel. Operators must be fully trained to operate and maintain their equipment. Some types of terrain can have a severe effect on suspension and transmission systems, especially those of wheeled vehicles. Items affected by mileage, such as wheels, steering assemblies, track wedge bolts and sprocket nuts, and transmission shafts, must be checked for undue wear when completing before-, during-, and after-operation maintenance checks.

Heat

3-165. Vehicle cooling and lubrication systems are interdependent; a malfunction by one rapidly places the other under severe strain. All types of engines may overheat to some degree, leading to excessive wear and, ultimately, to leaking oil seals in the power packs.

3-166. Commanders should be aware of which vehicle types are prone to overheating and ensure that extra maintenance is given them. Check oil levels frequently (a too high level may be as bad as a too low level) and check seals for leaking. Keep radiators and airflow areas around engines clean and free of debris and other obstructions. Water-cooled engines should be fitted with condensers to avoid waste of steam through the overflow pipe. Cooling hoses must be kept tight (one drip per second amounts to seven gallons in 24 hours). Operators should not remove hood side panels from engine compartments while the engine is running; this causes turbulence, leading to ineffective cooling.

3-167. Batteries do not hold their charge efficiently in intense heat. Battery-specific gravity must be changed to adjust to this environment. The unit can either adjust the electrolyte to 1.200 or 1.225 specific gravity or obtain sulfuric acid with a specific gravity of 1.2085 to 1.2185. Air vents must be kept clean or vapors may build up pressure and cause the battery to explode. Voltage regulators should be set as low as practical. Stocks of dry batteries must be increased to offset the high attrition rates caused by heat exposure.

3-168. Severe heat increases pressure in closed, pressurized systems and increases the volume of liquids. Care must be exercised to ensure that working pressure of all equipment is within safety limits. Caution must be exercised when removing items such as filler caps. Some items of equipment are fitted with thermal cutouts that open circuit breakers when equipment begins to overheat. Overheating can be partly avoided by keeping the item in the shade and wrapping it in a wet cloth to maintain a lower temperature by evaporation. Wood shrinks in a high-temperature, low-humidity environment. Equipment such as axes carried on tracked vehicles can become safety hazards as heads are likely to fly off as handles shrink.

3-169. Keep ammunition away from direct heat and sunlight. If it can be held by bare hands, it is safe to fire. White phosphorous ammunition filler tends to liquefy at temperatures over 111°F, which will cause unstable flight unless projectiles are stored in an upright position.

Radiant Light

3-170. Radiant light or its heat effect may be detrimental to plastics, lubricants, pressurized gases, some chemicals, and infrared tracking and guidance systems. Items like CO₂ fire extinguishers, M13 decontamination and reimpregnating kits, and Stinger missiles must be kept out of constant direct sunlight. Because optics may discolor in direct sunlight, limit their exposure to the sun's rays.

Dust and Sand

3-171. Dust and sand are probably the greatest dangers to efficient functioning of equipment in the desert. Lubrication must be the correct viscosity for the temperature; it must be kept to the absolute minimum in

the case of exposed or semiexposed moving parts. Sand mixed with oil forms an abrasive paste. Lube fittings, which are critical items, should be checked frequently. Teflon bearings require constant inspection to ensure that the coating is not being removed. Engine maintenance is critical due to the strong possibility of sand or dust entering cylinders or moving parts when the equipment is stripped. Screens against flying sand are essential; they also provide shade for mechanics.

3-172. Examine and clean air cleaners on all equipment at frequent intervals. The exact interval depends on operating conditions but should be at least daily. Use filters when refueling all vehicles, and keep the gap between the nozzle and the fuel tank filler covered. Fuel filters require frequent cleaning; oil filters require replacement more often. Engine oils require changing more often than in temperate climates. Windblown sand and grit will damage electrical wire insulation over time. All cables that are likely to be damaged should be protected with tape before insulation becomes worn.

3-173. Sand will also find its way into parts of items like spaghetti cord plugs, either preventing electrical contact or making it impossible to join the plugs together. A brush (an old toothbrush, for example) should be carried and used to brush out such items before they are joined.

3-174. Dust affects communication equipment such as amplitude-modulated radio frequency (AM RF) amplifiers and radio-teletypewriter sets. The latter, especially, are prone to damage due to their oil lubrication, so dust covers should be used whenever possible. Some receiver-transmitters have ventilating parts and channels that can get clogged with dust. Check them regularly and keep them clean to prevent overheating.

3-175. Weapons may become clogged or missiles jammed on launching rails due to sand and dust accumulation. Sand- or dust-clogged barrels can lead to in-bore detonation. Keep muzzles covered by a thin cover so an explosive projectile can be fired through the cover without risk of explosion.

3-176. Missiles on launchers must also be covered until used. Working parts of weapons must have minimum lubrication. It may even be preferable for them to be totally dry, as any damage caused during firing will be less than that produced by the sand-oil abrasive paste.

3-177. All optics are affected by blowing sand, which gradually degrades their performance due to small pitting and scratches. It is necessary to guard against buildup of dust on optics that may not be apparent until low-light optical performance has severely deteriorated. It may be advisable to keep optics covered with some form of cling film until operations begin, especially if the unit is near a sandstorm. Store optics in a dehydrated condition using hygroscopic material. Those in use should be kept where free air can circulate around them and be purged at frequent intervals.

3-178. Sand and dirt can accumulate in hull bottoms of armored vehicles and, when combined with condensation or oil, can cause jamming of control linkages. Sand accumulation in the air bleeder valve can inhibit heat from escaping the transmission and result in damage.

Temperature Variations

3-179. In deserts with relatively high dew levels and high humidity, overnight condensation can occur wherever surfaces are cooler than the air temperature (such as metal exposed to air). This condensation can affect optics, fuel lines, and air tanks. Fuel lines should be drained night and morning; optics must be cleaned frequently. Weapons—even if not lubricated—will accumulate sand and dirt due to condensation, another reason for daily cleaning.

3-180. Air and fluids expand and contract according to temperature. Tires inflated to correct pressure during the night may burst during the day. Fuel tanks filled to the brim at night will overflow as temperatures rise. Check air pressure when equipment is operating at efficient working temperature and fill fuel tanks to their correct capacity as defined in the appropriate technical manual.

Static Electricity

3-181. Static electricity is common in the desert, caused by atmospheric conditions coupled with an inability to ground out due to dry terrain. It is particularly likely with aircraft or vehicles having no conductor contact with the soil. The difference in electrical potential between separate materials may cause a spark on contact; if present, flammable gases may explode or cause a fire. A grounding circuit must be established between fuel tankers and vehicles being refueled, it must be maintained before and during refueling, and both tankers and vehicles must be grounded.

Winds

3-182. The velocity of desert winds can be destructive to large, relatively light material, such as aircraft, tentage, and antenna systems. To minimize wind damage, materiel should be given terrain protection and firmly picketed to the ground.

MAINTENANCE SUPPORT

3-183. Following are general guidelines for desert repair of equipment:

- Repair only what is necessary to make the equipment combat-ready.
- Recover the equipment to the nearest reasonably secure site, followed by on-site repair.

Establish a recovery and maintenance SOP before or immediately after arrival in theater. The SOP should include—

- Crew-level recovery and expedient repair.
- Unit-level maintenance recovery.
- DS-level maintenance recovery.
- Recovery priorities by vehicle types.
- Limitations of field expedient recovery techniques (for example, the distance/time that one tank is allowed to tow another considering the heat buildup in transmissions in this environment).
- Security and guides for recovery teams.

3-184. The recovery plan should include locations of maintenance collection points for equipment that cannot be repaired forward. These points must be

located where they can be reached by HETs, which may require the recovery vehicle to perform a longer than normal tow.

3-185. The maintenance collection point should cover a large area to allow for dispersion of supporting unit's equipment and inoperable weapon systems. An MST from the forward maintenance unit will normally be located at the maintenance collection point to determine disposition of inoperable equipment. Equipment authorized for disposal may be used for controlled exchange to support the repair of like vehicles. When considering recovery in the desert, pay special attention to ground-anchoring equipment since natural anchoring material is scarce.

COLD WEATHER OPERATIONS

3-186. One of the major problems for units operating in cold weather conditions is the lack of personnel with adequate training in cold weather operations and maintenance support. If troops stationed in warm climates must move to cold climates to perform their mission, cold weather training is of utmost importance. Much time and energy in cold weather areas are expended in self-preservation, which reduces personnel efficiency in operating and maintaining materiel. Maintenance personnel must learn how to live and work in cold regions.

LOCATIONS

3-187. Operation of materiel in temperatures down to -10°F presents few problems. Conditions are similar to those in the northern portions of CONUS during the winter. From -10°F to -40°F, operations become difficult.

3-188. Proper training will prevent failures of materiel and injuries to operating personnel. When the temperature is below -40°F, operations become increasingly difficult. At temperatures near -65°F, the maximum efforts of well-trained personnel are required to perform even a simple task with completely winterized materiel. Figure 3-3 shows the levels of increasing difficulty as temperatures drop.

SECURITY

3-189. Enemy ambushes are always a threat in snow-covered terrain. Since units must furnish their own security, reconnaissance, and surveillance, camouflage is a basic tool used to defeat detection by the enemy. In the absence of issued camouflage uniforms, soldiers can improvise camouflage suits, adapting color and pattern to the terrain background.

3-190. A white garment designed to blend with a white or mottled white and black background is used in snow-covered terrain. This snowsuit does not conceal small patches of shadow that surround a human figure, but this is not necessary since snow country usually contains numerous dark spots and shadows. If certain snow areas are all white with absolutely no shadows, make use of defiles and natural folds in the ground.

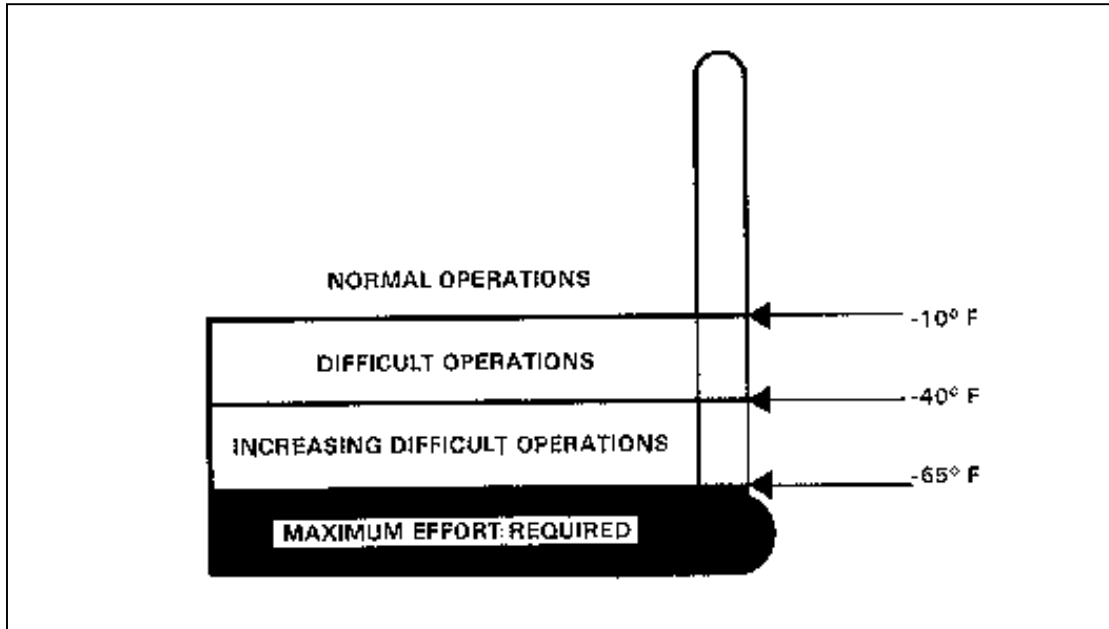


Figure 3-3. Cold Weather Operations—Levels of Difficulty

CLASS IX SUPPLY SUPPORT

3-191. The effect of cold weather on Class IX supply support makes handling and storage of materials of prime importance. Supplies are delivered as far forward as weather, terrain, and the tactical situation permit. However, supply-handling requirements will vary significantly from those encountered in temperate climates:

- Metals become brittle at extremely low temperatures; parts cannot withstand the shock loads that they sustain at higher temperatures.
- Extreme care is required when handling rubber-covered cables at low temperatures. If rubber jackets become hard, cables must be protected from shock loads and bending to prevent short circuits caused by breaks in the covering. Neoprene jackets on cables become very brittle and break readily at low temperatures.
- Tires become rigid when cold, causing flat spots on portions that come into contact with the ground during shutdown periods. At extreme low temperatures, side walls become brittle and crack.
- Plastics expand and contract much more than metal or glass. Any parts or materials made of plastic must be handled carefully.
- Glass, porcelain, and other ceramics should perform normally at low temperatures if handled carefully. Cracking may result if heat is applied directly to cold windshields or vehicle glass.
- Fabrics retain their flexibility even at extremely low temperatures provided they are kept dry.

MAINTENANCE

3-192. Personnel must be aware of the importance of maintenance, especially PMCS. Maintenance of mechanical equipment is exceptionally difficult during cold weather. Automotive and other mechanical maintenance cannot be completed with normal speed because equipment must be allowed to warm up before maintenance personnel can make repairs. Routine tasks require additional time. The time lag, which cannot be overemphasized, must be included in all planning. Personnel efficiency is reduced by bulky clothing, which must be worn at all times

3-193. The resulting loss of the sense of touch further reduces efficiency. Even the most routine operations like handling latches or opening engine enclosures become frustrating and time-consuming with gloves. At temperatures below -20°F, maintenance requires up to five times the normal time. Complete winterization, diligent maintenance, and well-trained crews are the keys to efficient cold weather operations.

3-194. The following requirements affecting maintenance planning and preparation should be complied with before beginning a cold weather operation:

- Shelter for materiel requiring maintenance.
- Proper clothing and tools for maintenance personnel.
- Ground cover (plywood or canvas) for personnel to lie on under vehicles.
- Adequate portable heaters.
- Suitable methods to store and issue antifreeze materials, fuels, hydraulic fluids, and lubricants.
- Sufficient lighting equipment.
- Supply of repair parts for equipment.
- Sufficient equipment for removal of snow and ice.

WARNING

Provide proper ventilation to avoid the danger of carbon monoxide poisoning caused by operation of engines or from contaminated hot air from defective heaters.

Do not use heaters that produce contaminated hot air in buildings or maintenance tents where personnel are present.

BUILDINGS AND SHELTERS

3-195. Heated buildings or shelters are needed for cold weather maintenance operations. Maintenance of many components requires careful, precise servicing. Without heaters, the increase in maintenance man-hours will be from 25 to 500 percent above normal requirements. When buildings are not available, maintenance tents are used as a temporary expedient. When possible, wooden flooring should be laid inside all tents. Tents should be heated by portable duct heaters or tent stoves.

3-196. In the absence of buildings or maintenance tents, tarpaulins may be used as a field expedient to create overhead shelter and wind breaks. The tarpaulin can be supported on a framework of poles erected around the vehicle. Parachutes can also serve as temporary shelters. The parachute should be deployed over the vehicle, securely staked down at the bottom, and then inflated with air from a portable duct heater. If parachute shelters are used, extreme care should be taken to avoid carbon monoxide poisoning.

WARNING

Fill fuel tanks/containers of vehicles, generators, and POL containers brought into warm storage from the cold no more than three-quarters full. Failure to follow this procedure results in expansion of the cold POL products in the fuel containers, which could cause spillage and a serious fire hazard.

Be constantly on the alert to detect vehicle deficiencies that expose personnel to carbon monoxide poisoning. Inspect and test passenger and crew compartments of wheeled and tracked carriers at regular intervals to detect any signs of air contamination from exhaust gases due to leaking gaskets, improper exhaust installation, cracked exhaust pipes, defective personnel heaters, or auxiliary generators.

LIGHTING EQUIPMENT

3-197. Sufficient equipment must be available to furnish lights during maintenance operations. Lights with ample cable extensions, attachment plugs, connectors, and spare bulbs are essential.

MAINTENANCE PERSONNEL, TOOLS, AND EQUIPMENT

3-198. An increase in the number of mechanics will be required to maintain equipment in cold weather operations. As a minimum, a highly organized, more intensive effort is required of personnel on hand. Remember that the amount of work performed under cold conditions is considerably less than work accomplished in moderate temperatures.

3-199. An additional supply of battery chargers must be available to meet the heavy requirements for battery maintenance in subzero temperatures. Hydrometers and testers must be on hand to check the state of charge of batteries. Tools provided in the various tool kits are adequate for maintenance at subzero temperatures.

3-200. Gloves worn while performing maintenance on fuel systems and lubrication of cooling systems may become saturated with fluids. This reduces the insulating value of the gloves and may result in cold injury to personnel. Maintenance personnel should carry extra gloves.

3-201. Personnel should avoid leaning on cold soaked equipment or kneeling or lying on the ground. Rapid body cooling caused by heat transfer to the equipment or ground may result in cold injury. Some sort of insulation,

such as fiber packing material, corrugated cardboard, rags, or tarpaulins, should be placed between the mechanic/repairer and the equipment.

3-202. When performing maintenance under arctic winter conditions, a box or a pan should be used to hold small parts. A tarpaulin should be placed under the vehicle to catch parts that may be dropped to prevent them from being lost in the snow. See FM 9-207 for more information.

JUNGLE OPERATIONS

3-203. Maintenance units in a jungle environment retain the same basic mission and capabilities as in other environments. However, they must make adjustments due to terrain, weather, and vegetation.

LOCATION

3-204. Jungle operations subject personnel and equipment to effects not found in other environments. Traffic areas and security problems often affect maintenance units as much as maneuver forces. The lack of an extensive all-weather transportation network in many jungle areas makes the mission of support units more difficult. Transportation difficulties may dictate that maneuver units be resupplied by air, pack animals, or human portage.

SECURITY

3-205. Ambushes and infiltration characterize jungle combat operations. The security threat caused by infiltrators requires that lines of communication be patrolled frequently and that convoys be escorted. Therefore, maintenance support must be performed as far forward as the tactical situation permits. This improves response time, reduces road movement, and allows maintenance units to take advantage of the security offered by combat units.

CLASS IX SUPPLY SUPPORT

3-206. Repair parts that deteriorate or wear out faster in the jungle environment must be identified. The PLL must reflect the increased turnover of these parts.

MAINTENANCE

3-207. Maintenance units in the jungle function essentially the same as in other operations. High humidity and temperatures in jungle areas increase maintenance requirements. Preventive maintenance checks and services (PMCS) on any items affected by moisture and heat is extremely important. Emphasis must be placed on on-site maintenance and the use of aircraft to transport MSTs and repair parts to the supported unit. The need for responsive maintenance support means the number of repair parts for immediate use must be increased.

TRANSPORTATION

3-208. Maintenance units should consider the employment of all types of transportation. Surface transportation facilities are poor in most jungle areas; they cannot handle heavy military traffic without extensive improvements. An air line of communication can eliminate many of the problems associated with surface movement. Human portage is a basic

means of moving supplies and equipment in jungle operations, a method that, at best, is slow, laborious, and inefficient.

3-209. Wheeled vehicles are normally restricted to roads and wider trails, and even these may prove impassable during heavy rains. Sometimes repair parts must be transported by transloading from wheeled to tracked vehicles. For example, large wheeled vehicles move supplies as far forward as possible, where they are transloaded to tracked vehicles. Then tracked vehicles move them cross-country. In rugged terrain, supplies may require further transloading to pack animals or native supply bearers.

3-210. Fixed-wing transport aircraft can usually operate at greater distances without refueling than cargo helicopters. However, use of fixed-wing aircraft to land supplies requires more landing strips than may be present. Construction and maintenance of airfields in jungles are difficult engineering tasks, but a savanna may be large and firm enough to use as an airstrip.

3-211. Airdrop of supplies is an alternative to air landing. Airdrop makes deliveries to isolated units possible without further transloading. Disadvantages include the dispersion of supplies and the possibility of lost cargo under the jungle canopy, vulnerability to local enemy air defense, and requirements for at least local friendly air superiority.

MOUNTAIN OPERATIONS

3-212. Historically, the focal point of mountain operations has been the battle to control the heights. Changes in weaponry and equipment have not altered this fact. In all but the most extreme terrain and weather, infantry, with its light equipment and mobility, remains the basic maneuver force in the mountains. With proper equipment and training, infantry is ideally suited for fighting the close-in battle commonly associated with mountain warfare. Mechanized infantry can also enter the mountain battle, but it must be prepared to dismount and conduct operations on foot. Because of the severity of the environment, maintenance support in mountainous areas can be somewhat difficult.

LOCATION

3-213. Due to terrain constraints, it may be necessary to disperse support units over a wide area. Dispersion reduces the vulnerability of maintenance units; however, it may cause problems with command, control, and local security. Because maintenance units will be high-priority targets, they must have adequate protection against ground and air attack to ensure continuous operations. In all cases, maintenance units must locate as far forward as possible.

SECURITY

3-214. Mountains provide excellent opportunities for ambush and attacks on vehicle traffic on MSRs. Enemy units can be airdropped or air-landed on key terrain that dominates supply routes. Maintenance units must be alert for enemy infiltration detachments that may seize important road junctions to isolate combat units from maintenance support. Route patrols and observation posts are required to secure MSRs.

CLASS IX SUPPLY SUPPORT

3-215. In mountain operations, rugged terrain and climatic extremes cause repair parts consumption to increase. Movement of repair parts should be expedited into and within the combat area. Parts with high usage rates should be stocked on the authorized stockage list (ASL) at both the MSB and FSB. Typical high-consumption repair parts include—

- Tires.
- Tie rods.
- Transmissions.
- Brake shoes.
- Tracks and pads.
- Final drives.
- Winch parts.

3-216. Isolated operations require an increased repair parts stockage in each category; however, ASLs should contain only those repair parts that are combat-essential and demand-supported for a particular piece of equipment.

MAINTENANCE

3-217. Fixing equipment as far forward as possible is extremely important in mountain operations. Vehicle crews and maintenance personnel must be trained to evaluate damage to their equipment accurately. Repair should be accomplished by maintenance teams from the organizational maintenance element of the supported unit or by MSTs from the DS maintenance company. Recovery of equipment will be very difficult. When recovery is required, equipment should be moved only as far rearward as the point where repairs can be made, frequently the combat trains area.

TRANSPORTATION

3-218. Although vehicles are used to move a large share of repair parts forward, they are not always able to reach deployed units. Locally obtained animals or individual soldiers must often move repair parts from roads to unit positions. Whenever possible, use vehicles to move heavy, bulky items or repair parts.

3-219. When weather permits, use helicopters to move repair parts from the supply support activity directly to forward units. Helicopters speed resupply operations and reduce multiple handling. Helicopters are good for emergency resupply and movement of high-priority supplies; they should be used whenever possible. Resupply by US Air Force aircraft is another option.

URBAN TERRAIN

3-220. The urban battlefield does not cause significant changes in maintenance doctrine or organizations. However, it does impact on how maintenance is provided. Urban regions normally contain a well-developed distribution system, major portions of which are highways, rail lines, airfields, manufacturing plants, and storage areas.

3-221. Built-up areas frequently provide suitable locations for deployment of maintenance units. Such areas offer excellent cover and concealment and

may contain easily adaptable maintenance and storage facilities. At the same time, rubble or damaged built-up areas may present obstacles along lines of communication, which are vital to effective functioning of maintenance units.

LOCATION

3-222. Because of the tactical situation, maintenance units may support from a built-up area. When using built-up areas, protection and physical security become important considerations. Supplies and equipment must be protected from both enemy attack and theft. Refugees may seriously impede or block movement over routes required by MSTs or movement of equipment to MCPs. Maintenance units may take advantage of hard stands, overhead lift, installed communication systems, and maintenance facilities existing in their areas of responsibility.

SECURITY

3-223. Buildings provide excellent locations for snipers and thieves to use to attack maintenance units. Maintenance units must be alert for enemy infiltration detachments that may move among the civilian population. Maintenance shop areas should be blocked off with patrols and observation posts, as required to secure the area.

CLASS IX SUPPLY SUPPORT

3-224. In urban terrain operations, vehicle repair parts usage may decrease as units dismount. Consumption of repair parts for small arms and engineer equipment may subsequently rise. Concentrated operations allow centralized control of repair parts in urban operations. MSTs may operate on site with the supported unit or from the base company location.

MAINTENANCE

3-225. Fixing equipment on site is extremely important in urban operations. Organizational maintenance personnel must be trained to evaluate damage to their equipment accurately. Recovery of equipment will prove very difficult. When recovery is required, equipment should be moved only as far rearward as the point where repairs can be made. When selecting the maintenance site, consider—

- Security.
- A sufficient area around equipment for lift or recovery vehicles to operate in.
- Use of a nearby maintenance facility or garage.

TRANSPORTATION

3-226. Although wheeled vehicles are used to move many repair parts forward, they are not always able to reach the unserviceable equipment due to rubble and blocked roads. Tracked vehicles can often move repair parts forward over the obstruction. Individuals and soldiers must often move repair parts from clear areas to equipment locations.

